CHASSIS LUBRICATION
Lubricate for SAFETY every 1,000 MILES

VOLUME VII • NUMBER 4 JULY, 1943

The Proper Handling and Application of Lubricating Greases

By CHAS. I. KRAUS

Before the National Lubricating Grease Institute's Annual Convention at New Orleans, La., October, 1942.

As we near the end of a year at war, the urgency of conservation is demanding more and more of our attention. Confronted by the biggest production responsibility in history and a whole world at stake, the skillful utilization of our man power, natural resources, manufacturing and transportation facilities have become a *must*.

It seems only a few short months ago that such subjects as restrictions of critical materials—talk of shortages to come, merely made good topics for conversation. Oh, they might effect the other fellow a little, but to most of us, they seemed something far removed. Shortages—here in the old U. S. A. where our problems for decades have been not how to *produce* as much as we can consume, but to *consume* what we could produce—that couldn't be. There would be plenty for the great war machine, and yes, for civilian consumption too. Now—such reasoning has given way to stark realism.

Consider the case of your own industry. Steel and tin containers must now give way to wood and fiber packages. The number of container sizes must be reduced. A number of ingredients used in the compounding of your products are no longer available. Transportation is becoming more difficult. Yes, in some instances, sales promotion programs have necessarily been replaced by sales prevention plans.

The enormous job confronting American industry is, I am sure, well known to all of you—re-tooling and plant expansion—full time twenty-four hour operation—increase in machine speeds and loads—all-out production, frequently with untrained hands due to the tremendous influx of new workers to war industries.

To furnish lubricating greases in sufficient volume for this industrial giant, plus the requirements of a great mechanized war machine, plus the increasing requirements of our allies is no small job. In the face of this task, the statement "Lubricant is ammunition, use is wisely" applies, indeed, to lubricant and lubrication equipment producers alike. The dissemination of advice and instruction to eliminate waste and contribute to all-out production using existing equipment, is of vital consequence.

Your industry, has in recent years, made many important contributions to the science of lubrication. Products having excellent stability, possessed with extraordinary extreme pressure characteristics, improved resistance to heat, cold, and water have made their appearance in rapid succession. Well trained representatives of your organizations have done a good job in prescribing these new developments to industry. Improperly handled or applied, gentlemen, these products might become just as ineffective as good ammunition in a faulty gun.

All too frequently, and I say this from actual observation in the field, failures are attributed to greases when the greases are not at fault. Not uncommonly, greases are rejected, not because of their lubricating value, but because of their unsuitability for use in the equipment available for their application or due to inexpert careless handling.

It is indicated that as the variety of greases compounded continues to expand, and the scope of mechanical devices for their handling and application broadens, the petroleum industries and producers of lubrication devices should have a closer contact so that each may be kept more intimately informed of the other's problems and developments. Surely, while *your* main consideration is concerned with blending products having ability to lubricate well under a wide range of operating conditions, their behavior in lubricating devices under a wide range of operating conditions, should *not* be over-looked.

In this connection, and I should like to place particular emphasis on this, it is important that your industry have an intimate knowledge of what I will term the "pumpability of your products," keeping in mind the severe temperature conditions in distant lands, to which much of it will be exposed. I will discuss this factor more intimately a little later.

Irrespective of all the skill and care embodied in compounding your products, much can happen between the time they leave your plant and when they are finally applied to the bearing that can seriously effect their lubricating value.

Far worse, than merely reflecting on the quality of your lubricants, the lack of "Controlled Handling and Application of Greases" results in untimely shut-downs, lost production, lost man hours, and loss of bearings and parts that are becoming increasingly difficult to replace. So just as it is important that you and your field

(Continued on Page 3)

NATIONAL LUBRICATING GREASE INST. NLGI

Some Service Changes Under Mileage Rationing

By DON O. WILSON

General Service Manager The Studebaker Corporation

Promptly following the announcement of gasoline rationing and low-speed restrictions, Studebaker dealers were advised in a special bulletin entitled "*Studebaker Service under Mileage Rationing,*" to make certain definite changes in service procedures.

Outstanding among them was the change in lubrication schedules made necessary by low-speed driving, short trips, and infrequent operation. The bulletin pointed out that lighter grade engine oil was advisable and prescribed the special care which should be given to the car.

The owner's handling and care of his car are especially important because it is upon him that the burden falls for getting maximum efficiency and economy from his car. While the situation has now changed, some months ago when driving restrictions were first invoked most owners were not aware that infrequent use of their cars called for even closer attention to certain service requirements than was the case when their cars were receiving normal usage. Here was a job of educating his customers which we knew the dealer could do, and the factory backed him with extensive advertising and consumer information booklets on car conservation and care.

We continuously emphasized that every available automotive vehicle is an essential and needed unit in the nation's transportation system, and that the maintenance of these cars depends in large measure upon the intelligent and whole-hearted effort of America's automotive service men.

We knew, of course, that many owners would consider it advisable to change oil frequently regardless of how few miles had been driven since the last change. Unfortunately, many others would not see the necessity for changing oil after a comparatively few miles of operation and it was for this reason that Studebaker urged its dealers and service men to re-schedule lubrication and inspections on a *time* rather than mileage basis.

While driving conditions vary so greatly that it was not advisable to establish definite time limits for changing engine oil, we recommended that the oil be inspected at the end of each thirty days for evidence of accumulated water or sludge at the bottom of the oil pan.

As it is not easy to remove the crankcase drain plug and replace it without losing considerable oil, procedures were suggested for drilling and tapping the drain plug and installing a small inspection plug which could be removed and readily replaced. The inspection of the oil is then relatively simple.

The service man merely drains one-half pint into a small glass container. If he finds the oil discolored or if bubbles or globules are apparent the oil should be changed. If after settling, there is one-fourth inch of water at the bottom of the container the oil should be changed.

The important point for the service man —and the owner—to remember today is that he must *watch the oil itself rather than the odometer.* The dipstick should be examined frequently for black or dirty appearance which indicates formation of sludge or worn out oil. Dirty or contaminated oil should always be changed regardless of time or mileage accumulated since the previous change.

SAE 10 oil was recommended for year around use in cars driven no more than 35 m.p.h. Under unusual circumstances which call for considerable use of the lower gears as in driving in heavy mud, mountainous country, etc., heavier oil should be used.

Since lubrication serves not only to reduce friction, but also to keep metal surfaces covered and protected, restricted operation calls for a generous amount of such protection. Greases are apt to dry out, and other lubricants to become dirty or to undergo chemical changes. To insure maximum life of moving parts no car should go more than 30 to 60 days without fresh chassis lubricant. Wheel bearings and universal joints should be repacked at least semi-annually regardless of mileage. Similarly, transmission and differential assemblies should be flushed and the lubricant changed in the spring and fall.

The cooling system also comes in for special attention because of low speed driving which allows particles ordinarily kept in circulation to settle in the block and gradually close passages. Reverse flushing both when installing and removing anti-freeze helps to assure free circulation. It is important also to use a rust inhibitor at all times to stop corrosion.

The thermostat should be carefully checked since a thermostat valve which does not open and close properly will allow the engine to overheat or to run at such low temperature that the accumulation of condensation and sludge in the crank case is encouraged. Low engine temperature also causes loss of power and poor performance with its resulting waste of fuel.

Many service men have heard the complaint in recent months that mufflers don't seem to hold up. Few owners appreciate that a muffler will deteriorate more rapidly when the car is not in regular use.

Naturally, disintegration of mufflers and tail pipes is hastened by restricted driving when the moisture in the system is not evaporated rapidly enough to arrest corrosion.

One of the more serious problems is that of supplying sufficient electrical current for operating integral electrical units and accessories, particularly in cold weather. While this problem will be of lesser importance in the coming summer months, few owners know that a battery must be warm before it will take a charge normally, and that in slow driving on a short run in winter it is possible for most of the output of a generator to be consumed in heating a battery rather than in charging it. Also, a discharged battery deteriorates rapidly and may be quickly ruined through freezing.

Studebaker dealers and service men are urged to make a battery check twice monthly. Less drain on the battery results if the choke is set for easy starting and free operation. Attention should be given to keeping the generator in condition for maximum operation at low speed. We advise that the engine idle speed should be set so that the battery ammeter will not show discharge at idling speed without lights or accessories. The service man should check the wiring for slow current leaks and keep the engine tuned for quick starting.

In winter, for some owners it may be necessary to reduce the use of electrical accessories. Whether or not this should be done can be determined by the service man's knowledge of the conditions under which the car is used.

Space does not permit detailing all the various items which the service man should watch today. Actually, while the changes in service procedures are significant there are relatively few of them. It is of equal importance, we believe, that the service man overlook none of the regular service procedures and inspections which are recommended for normal usage. By paying close attention to all items of car care, the service

The INSTITUTE SPOKESMAN

Published monthly by

THE NATIONAL LUBRICATING GREASE INSTITUTE

GEORGE W. MILLER ..... *Editor*

498 Winspear Avenue, Buffalo, N. Y.

Associate Editors

J. R. Battenfeld — W. H. Oldacre

M. B. Chittick — W. H. Saunders

E. V. Moncrieff — H. G. Vesper

man will have accomplished a great deal in keeping his customers' cars in good operating condition.

MODERN LUBRICATION FOR BEARINGS

"Some weird methods of preventing overlubrication of rear wheel bearings which often ruins brake linings have been called to our attention. Some remove the lubrication fitting entirely and install screw plugs. One hammers the fittings into a pulp so that the man with the grease gun will not recognize them for what they are," the *Studebaker Service Bulletin* reports.

"We don't question the effectiveness of these methods, but—what happens when the bearings need lubricant? 'Lubrication in moderation' is a slogan we thought up to fit the occasion. If over ambitious outside stations force enough lubricant into these bearings to damage the seals and fill the brake drums as well, fool them by putting small grease cups in place of the gun fittings. Few lubrication men, even if they take their vitamin pills regularly, will do much damage through overlubrication by repeated fillings of a small grease cup."

The Proper Handling and Application of Lubricating Greases

(Continued from Page 1)

representatives understand the operating mechanism of machinery and its influence on the selection of specific greases, it is equally important that you and your field representatives study and thoroughly understand lubrication devices and handling equipment, their adaptabilities and limitations.

Common causes of bearing failures, which may be traced directly to the handling of lubricants are:

COMMON CAUSES OF BEARING FAILURES

1. Failure to Centralize Lubrication Responsibility.
2. Lack of Planned Lubrication Schedules.
3. Inadequately identified Lubricants.
4. Contamination of Lubricants.
5. Inadequate lubricating Devices.
6. Inaccessible Provision for Lubrication.
7. Over or Under Lubrication.

1. *Failure to Centralize Lubrication Responsibility.*

Up until very recently, it has been a common practice to entrust the lubrication maintenance of machinery, representing large investments to the hands of untrained men or machinery operators. Many concerns have recognized that this procedure is far from economical. Others, however, continue with this outmoded practice. Modern preventive lubrication maintenance demands the services of a trained specialist who can devote his full attention and study to lubricants and lubrication methods and who is fully familiar with the most exacting lubricating requirements of the equipment for which he is responsible.

2. *Lack of Planned Lubrication Schedules.*

Schedules outlining lubrication requirements of all equipment clearly and concisely should be prominently posted. Slipshod inconsistent treatment carries with it costly consequences.

3. *Inadequately Identified Lubricants.*

Your organizations exercise particular care in prescribing the correct specialized lubricants to do a job, and normally the containers are clearly identified. Frequently the product loses its identity after being received by the user and becomes just another barrel of grease. This condition has become exaggerated due to inexperienced personnel. Industry should be urged to clearly identify each petroleum product, denoting its specific application.

4. *Contamination of Lubricants.*

Careless handling of greases is still one of the most wide-spread abuses encountered in industry, even amongst some of the best managed organizations. There is possibly no more simple manner to sabotage industrial machinery, intentionally or unintentionally. A hand full of emery dust, metal chips or other contaminants, introduced to a barrel of grease can do incalculable damage. Industry must be increasingly vigilant against this danger. Open grease buckets, wooden paddles, *must go.* Provisions for transferring lubricants from the original containers, ultimately to the bearings without exposure, are available for plants of all sizes, and their wide spread adoption should be urged.

5. *Inadequate Lubricating Devices.*

You have all heard the statement that the easier you make it for a man to do a job, the more likelihood there is of that job being done well. In the case of lubrication devices this surely applies. Where a lubrication responsibility is great, adequate devices should most assuredly be supplied. An operator, fatigued because of not being equipped with adequate devices, frequently fails to do a satisfactory job. The man with the lubricating gun in industry is just as important as the man with the gun in the front lines.

6. *Inaccessible Provision for Lubrication.*

Lubrication devices located in remote inaccessible locations, provide a real obstacle to proper lubrication. In addition to en-

dangering the safety of the operators, such conditions, all too frequently, encourage neglect.

7. Over or Under Lubrication.

Bearings and other machine parts are frequently over or under lubricated. The first condition causes over-heating, due to high internal friction with consequent power loss, accelerated wear, repairs, lubricant wastage, contamination of product being processed, untidy appearance, and fire hazard. Under lubrication results in excessive wear, friction, over-heating, all of which effects the normal life that can be expected from bearings and machines. As you will see, mechanical devices are available, which contribute greatly to eliminating these conditions.

Millions of pounds of your greases are annually introduced to bearings through Pressure Gun Fittings.

A method which was introduced many years ago and which is just as essential today as it was then, is known as the Barrel to Bearing System. This system which is applicable to plants of any size, provides for the transferring of lubricant from the original container to this auxiliary filler tank which has a capacity of thirty-five pounds and can be carried conveniently throughout the plant. Lubricant is transferred from the filler tank through the hollow handle of the gun, insuring that the gun is packed full with clean lubricant and also eliminating any air pockets in the gun, which are frequently the result when filling by means of paddles. Lubricant having never been exposed to daylight, is then introduced to the pressure gun fittings. Both Push Type Guns, and Lever Type Guns, also commonly used in industry, may be loaded in this manner.

Pressure Gun Fittings made their bow at the time of the last World War when they were adopted as standard equipment on trucks of the White Motor Car Company. The original Pin Type System was rapidly adopted by the motor car industry as well as by many large manufacturers of industrial machinery. Due to subsequent developments they have been pretty much superseded by other pressure systems of improved design.

The Hydraulic System is by far the most generally used of all pressure gun systems today. The tip of these fittings is ball shaped and the coupler on the end of the gun is constructed with three jaws which grasp the fitting immediately upon contact, providing a leak proof seal. As the pressure is built up this seal becomes tighter due to hydraulic pressure. These fittings are equipped with ball checks which open to admit lubricant under pressure then close, sealing the bearing against dirt and preventing leakage from back-pressure in the bearing. They are manufactured in a great variety of thread sizes and angles.

Another type of fitting which is prominently used in industry, particularly on conveyors, steel mill machinery, tractors, road machinery, etc., is the Button Head System. The design of these fittings is such that they adhere very closely to the bearing which prevents their being readily knocked off or injured. The coupler which slides over this fitting to engage it, wipes off the face of the fitting and any dirt or grease which has accumulated on the fitting is pushed out through a groove provided for this purpose. This automatically assures clean lubricant being introduced to the bearing.

Pressure gun fittings to perform a number of special functions are now available. Take for example the fitting which is known as a Lubri-guard fitting and prevents over lubrication. This fitting is manufactured without a ball and spring and with a milled slot across the threads. In practice, high pressure can never be applied to a bearing equipped with this fitting because lubricant contained in the bearing (and trapped air) quickly build up a back pressure sufficient to drive lubricant out the slot. Lubricant appearing at the slot is the signal that the bearing is adequately lubricated. Should lubricants be applied too frequently and a rise in pressure because of heating expansion develop, escape of pressure or lubricant is permitted through the milled slot as well as the opening in the fitting. Thus one of the greatest objections to pressure lubrication, such as on anti-friction bearings and bearings with sealed shaft ends, is definitely removed.

Many bearings and bearing seals today, must be protected against excessive pressure. The shut-off fitting is designed to prevent such excessive pressure being built-up within the bearing housings when lubricant is introduced. It is designed to shut off when a predetermined pressure is reached in the housing, preventing the entrance of any additional lubricant or a rise of pressure.

When bearings require periodical application of only a definitely small quantity of lubricant, the fitting which permits only 1/20 to 1/30 of an ounce of lubricant to be introduced at an application, is advantageous. This fitting is desirable for use where drippage of lubricant out of bearings, might be highly objectionable.

Where leakage of lubricant, due to back pressure within bearings or centrifugal action is objectionable, these leak proof fittings are frequently used. They meet government tests against back pressure leakage of gas or light oil and will withstand back pressures up to 5,000 pounds per square inch, and temperatures up to 180 degrees F.

The Pop-off Valve protects bearing hous-

ings and other assemblies from over-lubrication or high pressure built-up within the bearings or housings during operation. They are safety valves which open at predetermined pressures and permit the escape of lubricant and built-up pressure which cause destruction of seals as well as leakage.

Units which are air-vents provide protection against foaming as well as the generation of internal air pressure in gear cases. Hypoid Lubricant in differentials often foams when the gears are in operation and this builds up internal air pressure which can be damaging to seals and brakes. Air-vents placed high enough on the gear case to be above the normal level of lubricants, permits the escape of the built-up internal air pressure while retaining the lubricant in the housing.

Barrel to bearing lubrication by which means, lubricant is pumped from the original drum and piped throughout a plant just like air or water, is coming into more prominent use. In practice in a printing plant, a one inch line carries lubricant to the high speed presses, sixteen ½" pipes extend to the various cylinder bearings and to these are attached 20' lengths of flexible hose. This allows the operator to move in a wide radius with a supply of clean lubricant, under pressure, available at all times right at his finger tips. Air or electric operated equipment of this kind is manufactured for volume low pressure delivery as well as high pressure delivery of lubricating greases.

Until recent years, the disadvantage of pumping grease direct from the barrel in a manner such as the installation shown, was that only light bodied greases could be handled. A mechanical development, known as Dyn-a-matic Priming, now makes it possible to pump heavy bodied and fibrous greases, products having penetrations of 170 or 180 direct from the original container. While it is not my purpose to discuss in detail, mechanics of any lubricating device, this positive priming method represents such an important advance in pumping greases that I want to give you a brief insight as to how the job is accomplished. The Dyn-a-matic valve consists of a rod attached to the lower end of the lubricant piston on which is attached a plunger. On the downward stroke the valve emerges from the enclosed area of the tube, which is, of course, emersed in the drum of grease and a vacuum created by this movement, sucks lubricant through the ports into the evacuated space where it is ready for immediate delivery. The upward motion of the piston carries along the Dyn-a-matic priming valve which, upon entering the enclosed area of the tube, forces the lubricant previously trapped in this tube, definitely and positively into the priming chamber. The mechanical primer, performs the same function that your hand would perform, if you had it at the bottom of a drum of grease actually throwing lubricant into the high pressure chamber at each stroke of the piston.

By means of barrel pump equipment, lubricant can not only be pumped but may be rapidly and accurately metered. On this washing machine assembly line, one-half pound of lubricant is metered into their wringer drives as they come from the enameling ovens without removing them from the conveyor. The time consumed in this operation was reduced thirty-five percent. Mess, waste, and fire hazard were eliminated.

Lubricant can be metered in very minute quantities, even fractions of a gram. Grease is pumped from the original barrel to a pneumatically operated measuring valve which permits grease cups used on rear wheel bearings to be filled at the rate of 600 per hour, 10 per minute. This type measuring valve is easily adjusted to meter varying quantities.

Four crank shafts pass on this line a minute. Use of a measuring valve coupled with a positive primed gun, dispenses exactly one tenth ounce of lubricant at each turn of the level. Over-lubrication here would permit lubricant to get on the clutch facing. Time required to perform this operation has been reduced to one tenth of what was formerly required.

A typical example of the importance of introducing grease in metered quantities is shown where six grams of lubricant per roller are accurately dispensed through a positive primed gun. It is important that exactly the right amount of lubricant be dispensed inasmuch as this conveyor enters the Bonderizing oven and is exposed to heat that runs up to 400 degrees F. and over, and then back into the cool assembly room. The bearings must roll freely and not leak as that would spoil the Bonderizing. Excessive lubricant might also tend to carbonize in the rolls. On this particular installation there were 20,000 rolls to be lubricated, so you can understand the importance of doing this job rapidly and accurately. Surely, it is evident how faulty handling might reflect on the lubricant in an application such as this.

The ability of the positive prime grease guns used in connection with the measuring valves to pump heavy grease is made possible by a special construction. Each time the high pressure piston makes a stroke the helix arm and worm turn feeding the heavy grease to the high pressure chamber. The worm functions very much like a screw conveyor actually conveying the heavy grease to the intake port. Very heavy greases can

be handled as a result of this type of construction.

A pneumatically operated positive primed unit is in use in the plant of a large bearing manufacturer. It is actuated by a workman's foot leaving the operator's both hands free to hold the bearings while they are being lubricated. One operator is enabled to lubricate 3,000 bearings per day, each with a predetermined amount of lubricant.

In order to further speed lubrication and to insure thorough lubrication, a number of centralized grease systems have made their appearance. They have in common the ability to lubricate a number of bearings from a central point with a predetermined quantity of lubricant. Such type systems are available for manual operation or equipped with automatic pumping equipment and timing devices which make possible the complete elimination of the human element, where that is essential. The machine may be lubricated without shut down and the resulting interruptions of operation by employing various types of swivel and hose connections, lubricant may be introduced to revolving parts or to oscillating or eccentric motions with ease. With this system, when all bearings on a machine are lubricated, an indicator in direct view of the operator, signals that the lubrication job is complete. With one of these systems, even the most remote bearings are lubricated with ease.

A new development which is the result of the trend taken by modern plants which incorporates buildings of single story construction covering vast areas, is the Lubrikart. This permits centralization of the lubrication responsibility and provides a complete lubrication department on wheels so that power lubrication may be brought right to the machines. Pneumatically operated barrel pumps for handling pressure gun grease, machine oils, gear greases and any other lubricants necessary to the operation, are provided. The units may be procured complete with air compressors or with a reel equipped with air hose for plugging into factory air lines. Spring return reels accommodate necessary lengths of hose and control valves so that operators may work in a wide radius. Bins and drawers are also provided for tools and other necessary accessories.

A combination control valve and meter immediately in view of the operator, enables him to meter the exact quantity of lubricant dispensed. A totalizer which is also a part of this meter provides a record of the total poundage of lubricant used.

Keeping in mind at all time the need for keeping lubricant clean, means are provided for filling the lubricant containers without ever removing the pumps from the drums. The operator refills the units on a Lubrikart from a pneumatically operated grease transfer, which transfers grease from the original drum at the rate of twenty pounds per minute; thus, entirely eliminating the need of handling or exposing the grease.

There is a method of applying gear coating to open gears, which is being received favorably by industry. Application of gear coating in many plants today, requires a shut down of machines, removal of guards, and the brushing on of gear coating after it has been heated. By the installation of a pressure gun fitting, the gear coating may be applied through the fitting without interruption of operation and inasmuch as the gears are in motion, while the product is being applied, good distribution of the lubricant over the gear teeth is obtained. When gear teeth are over 3" in width, it is recommended that two fittings be used to assure adequate distribution of the grease over the gear tooth surfaces.

Application of rust preventive and slushing materials to equipment scheduled for export, has come in for added attention especially since the shipment of war implements and machinery overseas has been accelerated. While these rust preventives are frequently applied by being heated and brushed on, or by dipping the product to be treated, you may be interested in knowing that some of these very heavy rust preventives may be sprayed. This is accomplished by use of positive primed barrel pumps used in conjunction with spray heads such as those manufactured by the DeVilbiss Company or Binks. After the pumping mechanism performs the function of bringing the rust preventives out of the drum to the spray head, it is atomized by compressed air and may be sprayed very much like paint. This insures an even coating over all parts to be treated and a coverage of even remote parts which may be neglected by the brush method. It speeds the operation and is economical for the user insofar as cutting down the amount of material consumed. The air regulators regulate the amount of pressure from the pump and the amount of air to the air line so that the spray can be easily regulated.

This method is now also coming into use in the spraying of gear lubricant onto open gears.

Road building and construction equipment represents a vast lubrication maintenance responsibility, and the tremendous rolling stock employed by this industry, unlike passenger cars and trucks, cannot be brought to service stations. Portable Service Stations are now very prominently used which bring all the advantages of modern service stations to the equipment in the field. A typical example of one of these units employs two high pressure pumps, one for general pressure gun lubrication and one for tractor track rolls, two gear lubricant pumps for the volume dispensing of gear greases, and four motor oil pumps. All of the equipment is powered by a gas engine equipped air compressor, and you will observe also, a lighting plant which provides the power for trouble lights and flood lights on night work.

Another example of these Portable Service Stations, even more complete than the one already described, in addition to providing for the handling of the various greases and motor oils, is equipped with a 250 gallon tank for Diesel oil and gasoline, and an 80 gallon tank for water. Observe the convenient reels, all properly identified so that a great amount of construction machinery can be lubricated by power, rapidly and thoroughly.

Tests conducted by Ordnance proved that it was possible to completely lubricate four light tanks in eighteen minutes with one of these units; whereas, the normal time required, with manual methods, to lubricate the same vehicles was 1½ hours.

Of course the attention of all of us is focused on increased production whether it be stampings turned out by a giant press, screw machine parts turned out by an automatic, or yards of dirt moved by construction machinery. So, translated from time-saving to increased production, here is a typical example of what the use of a Portable Service Station meant to a contractor:

UNITS TO BE LUBRICATED 5
2 LUBRICATIONS PER DAY 10
PRODUCTIVE TIME REQUIRED FOR LUBRICATION WITH HAND GUN PER UNIT
20 MINUTES, OR A TOTAL OF 200 MINUTES FOR 10 LUBRICATIONS

TIME SAVED WITH PORTABLE SERVICE STATIONS—50% OR 100 MINUTES

100 MINUTES EQUAL 20 TRIPS—EACH TRIP MEANS 8 YDS. DIRT HAULED TOTAL
DAILY ADDITIONAL YARDAGE—
160 YDS. DIRT
CONTRACT PRICE—30C PER YD.

DAILY ADDED REVENUE $48.00

Just as a contractor is interested in moving the maximum yards of dirt per hour, so the miner is interested in mining the maximum tons of coal. Along with increasing mechanism in coal mines, comes the necessity for added attention to maintenance of equipment to insure continuous operation and the production of greater tonnage. Lubrication must be positive and lubricant must be kept free from abrasive coal dust. When the Portable Service Station principle is applied to the coal industry

for use in lubricating underground equipment, the operator sees that the barrels are loaded, hooks the locomotive to the service station and heads for the section. When he gets to the heading he lubricates loading and cutting machines, both high pressure fittings and gear housings, properly services Hydraulic cases with oil and leaves loader buckets filled, for auxiliary manual lubrication. A cutting machine for example, which normally required an hour and a half with manual method of lubrication, only takes twenty minutes to lubricate with this procedure. All lubricant is handled from "Barrel to Bearing."

Inasmuch as the battle is being fought by mechanical machines in the front lines as well as in our industrial plants, I thought you would be interested in a few developments for handling greases which have been designed specifically for various government departments. A Portable Service Station is being manufactured in a substantial volume for the U. S. Corps of Engineers. The development of this particular design is an offspring of our peace time experience in building Portable Service Stations for contractors and road builders. These units are built for mounting on trucks or trailers, and they are used for lubricating trucks, shovels, draglines, etc. They are being used on major construction projects all over the world. For example, quite a sizeable number of them are being used in connection with the construction of the Alaskan road and in the Panama Canal Zone and needless to say, the units must have the ability to handle greases exposed to a very wide range of temperatures. You will observe that the four lubricating pumps are mounted in 225 pound sealed tanks rather than in the original lubricant drums. There is also a unit for handling hydraulic brake fluid as well as compartments for tool equipment, and of course, reels for accommodating the hose and control valves.

The interesting construction which introduces exhaust from the gasoline powered air compressor to a chamber underneath the lubricant tanks helps to keep lubricants plastic at low temperatures.

The completeness of this lubricating unit for U. S. Engineers is further indicated by the contents of compartments provided for spare parts and specialized grease guns. These pumps handle special greases such as water pump and universal joint and an auxiliary one pound air operated gun for pressure gun fittings is also included. Spare parts to care for a year's service accompanies each station.

Another special development for mechanized forces, this one for the Motor Transport Division of Ordnance, is a gasoline operated grease dispenser with two tanks (capacity 30 lbs. each) so that gear and chassis lubricants are handled by one unit. One of the tanks (the high pressure unit) is equipped with a helicoid and worm to assure positive priming; the gear lubricant unit is fed by gravity and suction to the low pressure piston. Being equipped with a gasoline engine, it may be operated in any location. Each tank is equipped with a spill-proof cover. These guns are used principally to lubricate trucks, jeeps, peeps, scout cars, and half-tracks.

These units are mounted on convenient trucks. Special steel wheels were developed to supplant pneumatic tires and this substitution has really proved itself by providing excellent traction in mud. Two men can lift one of these units into a trailer and six of the guns will fit into a trailer, an important feature for cross-country hauling.

These units were subjected to three-day cold room tests and I cannot pass over this subject without again referring to the "pumpability" of lubricating greases. These particular tests were attended by Dr. Adams of the Standard Oil Company, and Mr. C. L. Knopf of the Sinclair Refining Company. Tests started at 30°F. and were decreased by 10° each test until results were recorded at 20° below zero F. A number of lubricating greases that are supplied on army specifications #2-106, as general chassis winter grade, cannot possibly be pumped at 20° below zero F. or at 0° F., because they become solid at these temperatures.

Consideration must be given to the fact that a tremendous amount of power is required to move cold greases through small orifices and the long length of hose necessary on some types of greasing equipment. Also it is desirable that summer grades of lubricant possess as wide a margin of safety as possible with respect to the possibility of their being used in cold temperatures. This is particularly important in war time when mechanized equipment will be used all over the world and when hair-line schedules, with respect to seasonal changes, may not always be adhered to.

The type of lubricating gun adopted by the Tank Corps is readily portable and may be operated by hand or foot. The leverage permitted by foot operations, you can readily understand, permits the development of tremendous pressure. This is a rugged piece of equipment well suited for this heavy duty service.

So you see progress has been made in devices for the handling and application of lubricating greases. A full understanding of these devices and their application by you, your organizations, and industry cannot help but contribute to the attainment of our common goal—all-out production for Victory.